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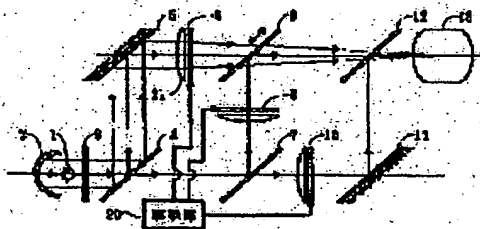
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(54) LIQUID CRYSTAL PROJECTOR

(57)Abstract:

PURPOSE: To adjust color reproducing characteristic and to increase the brightness of a screen.

CONSTITUTION: This projector is constituted of a light source for projection 1, a reflector 2, a cold filter 3 removing infrared rays, a red reflection dichroic mirror 4 reflecting only red light and transmitting green light and blue light, a 1st total reflection mirror 5 totally reflecting the red light, a liquid crystal panel for red 6, a 1st green reflection dichroic mirror 7 reflecting only the green light and transmitting the blue light out of the light transmitted through the dichroic mirror 4, a liquid crystal panel for green 8, a 2nd green reflection dichroic mirror 9 transmitting output from the panel 6, reflecting output from the panel 8 and having the film thickness of a dielectric multilayer film for correcting inclination, a liquid crystal panel for blue 10, a 2nd total reflection mirror 11, a blue reflection dichroic mirror 12, a projection lens 13, the condensing lens 21 of each liquid crystal panel, and a driving part 20 modulating and controlling each liquid crystal panel.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the liquid crystal projector which used the liquid crystal panel of a transparency mold as a light valve.

[0002]

[Description of the Prior Art] Make the optical image according to a video signal form in a liquid crystal panel, irradiate the light source light from said liquid crystal panel side, it is made to penetrate by performing that exposure luminous-intensity modulation with said liquid crystal panel, incidence of this transmitted light is carried out to a projection lens, and the liquid crystal projector of a projection mold which performs image display of a big screen is conventionally known using the approach of carrying out expansion projection of said optical image at a screen.

[0003] When performing full color image display of a big screen by the conventional liquid crystal projector, the configuration of the optical system shown in drawing 3 is adopted. In drawing 3, by passing the cold filter of 3 for the light from this reflector 2, it is a reflector for 1 to make the white light of this light source the light source for projection, and for 2 make it parallel light mostly, and unnecessary components, such as infrared radiation, are removed, among the lights which passed this filter 3, it is reflected by the red reflective dichroic mirror 4 and the first total reflection mirror 5, and incidence only of the red light is carried out to the liquid crystal panel 6 for red. Moreover, among the transmitted lights of the red reflective dichroic mirror 4, it is reflected with the first green reflective dichroic mirror 7, and incidence of the green light is carried out to the liquid crystal panel 8 for green. Furthermore, incidence of the transmitted light of said green reflective dichroic mirror 7 is carried out to the liquid crystal panel 10 for blue as it is. After being reflected with the second green reflective

dichroic mirror 9, the light which the light which penetrated the liquid crystal panel 6 for said red penetrated the second green reflective dichroic mirror 9, and penetrated the liquid crystal panel 8 for green passes the blue reflective dichroic mirror 12, respectively, and is compounded with the light in which the transmitted light penetrated the liquid crystal panel 10 for blue reflected by the second total reflection mirror 11. And the synthetic light is projected on a screen (not shown) with the projection lens 13.

[0004] By the way, by the order mirror method about color separation and composition of the liquid crystal projector explained to drawing 3, in order to supply light to the projection lens 13 efficiently, a condenser lens 21 is formed just before each liquid crystal panel. Moreover, since a dichroic mirror is installed at an angle of θ_2 to an optical axis as shown in (b) of drawing 4, the beam of light which condensed with said condenser lens has the include angle of θ_1 in an A point to a dichroic mirror, and has the include angle of θ_3 at C point. In addition, relation of each include angle is set to $\theta_1 < \theta_2 < \theta_3$, consequently — for example, the red (B) which orange (C) and Orange cut, the upper and lower sides having reversed and having applied caudad from the upper part on the screen as shown in (**) of drawing 4 when the red in which effect is most conspicuous was taken out and explained and red (A) — as — an irregular color occurs. As shown in (B) and (C), as shown to (Ha) of drawing 4, in the projection image of red Isshiki, a red luminescence property (A) causes an irregular color to a short wavelength side with the location on a screen from the first. In order to remove this irregular color, inclination amendment which thickness was changed to the second green reflective dichroic mirror 9 grade which penetrates red according to the amount of amendments, and prepared dielectric multilayers in it is carried out conventionally, and as shown in (d) of drawing 4, it amends so that the projection image of red Isshiki may be obtained in each location on a screen. Thus, irregular colors, such as said red-orange, were canceled.

[0005] However, since the dichroic mirror which carried out inclination amendment was being fixed, there was a problem decided as one kind to which the color reproduction property of a liquid crystal projector was set.

[0006]

[Problem(s) to be Solved by the Invention] This invention aims at offering the liquid crystal projector which improves the brightness of a projection image while it was made in view of the above-mentioned trouble and can adjust a color reproduction property.

[0007]

[Means for Solving the Problem] A color separation means to choose the output component of the light source which emits the white light, and said light source according to a wavelength field, and to separate into the three primary colors in order to attain the above-mentioned purpose; The liquid crystal panel of three sheets which the optical image according to a video signal is formed, and each output light of said color separation means in three primary colors is irradiated, carries out intensity modulation of the exposure light, and is made to penetrate. The condenser lens which is installed in front of said liquid crystal panel, and supplies light to this liquid crystal panel. In the liquid crystal projector equipped with a color composition means to carry out inclination amendment of the light of said liquid crystal panel in three primary colors, and to compound to one, and the projection lens which receives the output light from said color composition means, and projects said optical image on a screen. The liquid crystal projector which prepared the dichroic mirror which performed inclination amendment which carries out movable in parallel [with the inclination direction over an optical axis] as said color composition means.

[0008]

[Function] If one mirror is moved up as it is shown in the table of the drawing 2 (**), when its attention is paid to red by moving the dichroic mirror which carried out inclination amendment in parallel with the inclination direction of this dichroic mirror to an optical axis as shown in (**) of drawing 2 since it constituted as mentioned above, the purity of ** red will improve. ** ****ing in movement magnitude, based on the data defined beforehand, a mechanical component changes the modulation reinforcement of a light valve, and lowers green brightness to a blue list. Consequently, the color reproduction property of a projection image can be adjusted.

2) If a mirror is moved caudad, the purity of ** red will fall. ** ****ing in movement magnitude, based on the data defined beforehand, a mechanical component changes the modulation reinforcement of a light valve, and raises green brightness to a blue list. Consequently, the brightness of a projection image is made to increase within the limits of necessary white balance.

[0009]

[Example] Hereafter, the liquid crystal projector by this invention is explained to a detail using drawing. Drawing 1 is the example block diagram of the liquid crystal projector by this invention. The light source for projection for which 1 used the metal halide lamp etc., and 2 are the reflectors for making the white light of this light source into parallel light mostly, and 3 is a cold filter which removes unnecessary components, such as infrared radiation, by passing the light from this reflector 2. 4 is a red [who

makes green and blue penetrate] reflective dichroic mirror while reflecting only red among the lights which passed this filter 3. 5 is the first total reflection mirror which carries out total reflection of the red which said red reflective dichroic mirror 4 reflected. It is condensed with a condenser lens 21 and the red light which is the liquid crystal panel for red constituted from liquid crystal and a polarizing plate prepared before and after that, and said red reflective dichroic mirror 5 reflected inputs 6. 7 is first green reflective dichroic mirror which makes blue glow penetrate while reflecting only green light among the light which said red reflective dichroic mirror 4 penetrated. 8 is a liquid crystal panel for green, it is condensed with a condenser lens 21 and the green light which said first green reflective dichroic mirror 7 reflected inputs it. 9 is second green reflective dichroic mirror which penetrates the output of the liquid crystal panel 6 for said red, and reflects the output of the liquid crystal panel 8 for green and which inclined and was equipped with the thickness of the dielectric multilayers for inclination amendment. 10 is a liquid crystal panel for blue, it is condensed with a condenser lens 21 and the blue glow which penetrated said first green reflective dichroic mirror 7 inputs it. 20 is a mechanical component which controls the modulation reinforcement of said liquid crystal panel. Incidence of the transmitted light of said first green reflective dichroic mirror 7 is carried out to the liquid crystal panel 10 for blue as it is. After being reflected with the second green reflective dichroic mirror 9, the light which the light which penetrated the liquid crystal panel 6 for said red penetrated the second green reflective dichroic mirror 9 equipped with inclination amendment, and was amended by predetermined red, and penetrated the liquid crystal panel 8 for green passes the blue reflective dichroic mirror 12, respectively, and is compounded with the light which penetrated the liquid crystal panel 10 for blue by which the transmitted light was reflected by the second total reflection mirror 11. And the synthetic light is projected on a screen (not shown) with the projection lens 13.

[0010] Actuation of the liquid crystal projector by this invention is explained according to drawing 1 R> 1 and drawing 2. To the second green reflective dichroic mirror 9 shown in drawing 1, dielectric multilayers are formed in the incident light side of said second green reflective dichroic mirror 9 so that it may change from zero in succession to necessary thickness, so that it may have the inclination amendment property of drawing 2 (b). Since the transmitted light will penetrate C and D of the lower part of a dichroic mirror 9, and near E as shown in (**) of drawing 2 and penetrates incident light according to the inclination amendment property shown in (**) of drawing 2 when moving this dichroic mirror 9 up in parallel with the inclination

direction, as shown in the graph of drawing 2 (Ha), the purity of ** red improves. Based on the predetermined data to memorize, by controlling the modulation factor of each liquid crystal panel, a mechanical component 20 ****s in ** movement magnitude, changes the modulation reinforcement of a light valve based on the data defined beforehand, and lowers green brightness to a blue list. Consequently, the color reproduction property of a projection image can be adjusted.

[0011] Moreover, since the transmitted light will penetrate upper A and B of a dichroic mirror 9, and near C and penetrates incident light according to the inclination amendment property shown in (**) of drawing 2 as shown in (**) of drawing 2 when moving this dichroic mirror 9 caudad in parallel with the inclination direction, as shown in the graph of drawing 2 (Ha), the purity of ** red falls. Based on the predetermined data to memorize, by controlling the modulation factor of each liquid crystal panel, a mechanical component 20 ****s in ** movement magnitude, and based on the data defined beforehand, a mechanical component 20 changes the modulation reinforcement of a light valve, and it raises green brightness to a blue list. Consequently, the brightness of a projection image is made to increase within the limits of necessary white balance. Moreover, checking the color condition of a projection image, said data table is chosen, a color reproduction property can be adjusted or the brightness of a screen can be made to increase by preparing the data from which it ****s in movement magnitude and the modulation reinforcement of a green light valve is changed to a blue list at a mechanical component 20 at this time in two or more kinds data table formats. In addition, although it is the example which performs inclination amendment to the second green reflective dichroic mirror 9 in the above-mentioned explanation, and moves, the reason has the large aperture of the transmitted light of this dichroic mirror 9, is remarkable, and is because the effectiveness of amendment is large. [of change of a hue] Therefore, it not only limits to a dichroic mirror 9, but in order to heighten the effectiveness of amendment further, you may carry out the same amendment and migration to the blue reflective dichroic mirror 12.

[0012]

[Effect of the Invention] As explained above, this invention offers the liquid crystal projector which improves the brightness of a projection image while being able to adjust a color reproduction property. Therefore, since the dichroic mirror which carried out inclination amendment conventionally is being fixed, there is a merit which can solve the problem decided as one kind to which the color reproduction property of a liquid

crystal projector was set. Moreover, it is also possible to permit degradation of some color reproduction property and to raise the brightness of a projection image.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the example block diagram of the liquid crystal projector by this invention.

[Drawing 2] It is a graph explaining the actuation and the operation of a liquid crystal projector by this invention.

[Drawing 3] It is the example block diagram of the conventional liquid crystal projector.

[Drawing 4] It is drawing explaining actuation and an operation of the conventional liquid crystal projector.

[Description of Notations]

- 1 Light Source for Projection
- 2 Reflector
- 3 Cold Filter
- 4 Red Reflective Dichroic Mirror
- 5 First Total Reflection Mirror
- 6 Liquid Crystal Panel for Red
- 7 First Green Reflective Dichroic Mirror
- 8 Liquid Crystal Panel for Green
- 9 Second Green Reflective Dichroic Mirror Which Carried Out Inclination Amendment
- 10 Liquid Crystal Panel for Blue
- 11 Second Total Reflection Mirror
- 12 Blue Reflective Dichroic Mirror
- 13 Projection Lens
- 20 Mechanical Component
- 21 Condenser Lens

CLAIMS

[Claim(s)]

[Claim 1] The light source which emits the white light, and a color separation means to choose the output component of said light source according to a wavelength field, and to separate into the three primary colors, The liquid crystal panel of three sheets which the optical image according to a video signal is formed, and each output light of said color separation means in three primary colors is irradiated, carries out intensity modulation of the exposure light, and is made to penetrate, The condenser lens which is installed in front of said liquid crystal panel, and supplies light to this liquid crystal panel, In the liquid crystal projector equipped with a color composition means to carry out inclination amendment of the light of said liquid crystal panel in three primary colors, and to compound to one, and the projection lens which receives the output light from said color composition means, and projects said optical image on a screen. The liquid crystal projector which prepared the dichroic mirror which performed inclination amendment which carries out movable in parallel [with the inclination direction over at least one optical axis] as said color composition means.

[Claim 2] The liquid crystal projector according to claim 1 which only the transmitted light amends inclination amendment of the above-mentioned dichroic mirror, and is made into the amendment approach of not affecting the reflected light.

[Claim 3] The liquid crystal projector according to claim 2 characterized by forming the above-mentioned inclination amendment in a dichroic mirror so that dielectric multilayers may be continuously changed from zero to necessary thickness.

[Claim 4] The light source which emits the white light, and a color separation means to choose the output component of said light source according to a wavelength field, and to separate into the three primary colors, The liquid crystal panel of three sheets which the optical image according to a video signal is formed, and each output light of said color separation means in three primary colors is irradiated, carries out intensity modulation of the exposure light, and is made to penetrate, The condenser lens which is installed in front of said liquid crystal panel, and supplies light to this liquid crystal panel, In the liquid crystal projector equipped with a color composition means to carry out inclination amendment of the light of said liquid crystal panel in three primary colors, and to compound to one, and the projection lens which receives the output light from said color composition means, and projects said optical image on a screen. The liquid crystal projector characterized by preparing at least one dichroic mirror

which carries out movable, and which carried out inclination amendment, and the mechanical component which controls the modulation reinforcement of said liquid crystal panel as said color composition means, ***ing in a motion of a dichroic mirror, and changing modulation reinforcement for every liquid crystal panel.

[Claim 5] The liquid crystal projector according to claim 4 characterized by preparing two or more data of a class in a data table format in order to **** in the amount of motions of a dichroic mirror and to change the modulation reinforcement of a liquid crystal panel to the above-mentioned mechanical component.

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